COMMENTARY

# Journey to Now: The Origins of ABRF

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The development and expansion of the core facility concept are <4 decades old. The factors that favored the use of shared instrumentation facilities and the requirement for expert staff are covered by one of the founders of the Association of Biomolecular Resource Facilities (ABRF). During the decade when grants for shared instruments and the release of modern, automated instruments flourished, protocol development for those new instruments came primarily out of laboratories of the type we now call core facilities. Because of the new technologies available, new protocols were required to meet the needs of research communities, and much of the development took place in the diverse core facilities. Furthermore, technology development itself was a frequent activity in core facilities. Although guidelines for the operation of core facilities were not available in the early days of core facility operation, they evolved over time. Cost recovery was, and is still, one of the most problematic issues for core facilities. ABRF-supported research groups offered members opportunities to evaluate their capabilities with both lab-developed protocols and study-specified protocols and with comparative data collected in surveys of core facilities. Research groups are a premier activity of ABRF and its members. More new developing technologies have followed using this pattern of collaboration among core facilities and with industry. The exhibition floor at ABRF annual meetings shows off many of the results of these collaborations.

**Key Words:** core facilities, shared resources, shared instrumentation laboratory, research resources

## INTRODUCTION

Thank you, Sridar. Welcome everyone. I want to thank the organizers of ABRF2019 for this opportunity to talk about one of my favorite subjects, the Association of Biomolecular Resource Facilities (ABRF), which we usually call ABRF.

More than 30 years ago, the landscape of core facilities was very different. Back in the late 70s and early 80s, the landscape was barren; there were essentially no core facilities. Yes, there were clinical and pathology laboratories operating at that time. There also were electron microscope facilities; you will agree that those instruments are expensive, requiring expert personnel to operate. Flow cytometry was beginning to come into its own at about this time as well. That is about all there was then.

Perhaps the best example I can find for something we would recognize as a core facility was called the AAALaboratory, which offered amino acid analysis services. It was started by the late Lowell Ericsson in 1972 to serve health care and food-products industries (Ericsson L, 2019, personal communication).

What did researchers do if they needed access to an instrument of the day? Typically, they talked to a colleague who had that instrument and requested (or begged) for time on it. That was common. The burden of this courtesy was usually borne by the instrument laboratory, often with the quid pro quo agreement for coauthorship on resulting publications.

Instrumentation was different then in that there was little automation of the instruments; nothing like it is today. Furthermore, those instruments could not deal with micro amounts of sample. A few micromoles or even milligrams of a few samples could be run each day, not the picomole or nanogram amounts of samples that are automatically run in large batches every day now.

Think: life before Amazon!

So much for lamenting the conditions of scientific life in the 1980s.

In 1981, the U.S. National Institutes of Health came up with a milestone grant program: the Shared Instrument Grant, now often called S10. This infusion of funding for shared resources was exactly what was needed with the instruments then being developed. The first was

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the automated DNA synthesizer; it was already beginning to make its way into laboratories. Without access to a synthesizer, a graduate student or postdoc who needed a probe (oligo, oligonucleotide) spent a few months synthesizing it. The automated DNA synthesizer changed that: a probe became a reagent rather than a research project.

The Shared Instrument Grant program required sharing of instrument time by at least 3 investigators. This turned out to be critical to the evolution of the concept of core facilities as we know them today. The landscape could become lush.

1982 was another good year. Applied Biosystems (Foster City, CA, USA) commercialized the automated instruments developed in LeRoy Hood's laboratory at the California Institute of Technology. The DNA synthesizer was followed by an automated gas phase protein sequencer and a peptide synthesizer. They were automated so they could run without an attendant, *i.e.*, all night and all weekend. You can bet that I was more than happy with that, especially the weekend part. In 1986, an automated DNA sequencer came onto the market.

I am sure you can see where this is going: automation providing services and products that far exceeded what most laboratories needed. This of course was the focus of the Shared Instrument Grant program. But where did the concept of formal core facilities germinate?

Users of the early, new instruments had few protocols to choose from, leading to a time of intense development by those early adopters. Each laboratory was busy figuring out how to run its unique set of samples in order to really make the new generation of instruments productive. We were all testing the instruments and protocols on our own. Also, the newly available automation required more samples to keep these more sensitive instruments operating at peak efficiency, leading laboratories to begin dealing with many more outside samples.

In 1985 at the Symposium of American Protein Chemists, the audience was asked, "How many here regularly run samples that were not prepared in their laboratory?" More than 40 scientists responded and agreed to exchange information. Let me emphasize here; from this simple public question grew the ABRF we know today. It grew from grassroots. The visible example of a budding society was when these scientists agreed to exchange information by a mailing list. A network was developing to share ideas, learned experiences with automated instrumentation, increasing sensitivities, diverse sample types, and users. These participating scientists at that time realized that each of them was facing the same issues. Collaborating and sharing ideas would benefit not only their own laboratories but also help the outside researchers who used their capabilities.

Several people who ran what we now call a core facility built on the common desire to share their challenges and solutions by planning a meeting for the following year at the International Conference on Methods in Protein Sequence Analysis in 1986.[1] Note that while this was at another predominantly protein meeting, many of these protein chemists were also involved with studies using DNA. I must acknowledge those organizers as founders of what developed into ABRF: Donna Atherton (Rockefeller University), Audree Fowler (University of California, Los Angeles, a life member of ABRF), Rusty Kutny (DuPont), Alan Smith (University of California, Davis), myself (University of Wisconsin), and also Kenneth Williams (Yale University).

The first meeting organized was a session called Research Resource Facilities (RRF). It was attended by more than 100 scientists from 13 different countries. It was impressive, almost overwhelming to the organizers. A second meeting of the RRF was held in conjunction with the First Symposium of the Protein Society as a satellite meeting. These RRF meetings continued as satellite meetings to the Protein Society for the next 10 yr.

The RRF meetings focused on the nascent technologies coming from new instrumentation and on how to run a service. All the scientists were wrestling with the same things, and at RRF meetings they recognized that by sharing ideas they would make progress faster and more comprehensively.

Kenneth Williams initiated a study of the size, operation, and technical capabilities of protein and nucleic acid core facilities that was published in 1988.[2] This study was an effort to understand better what other laboratories were doing and how they operated. Although the concept of research groups was not yet on the table, this study was in fact what can be called the first research group study establishing the cultural approach for the future. Forty respondents provided data, thus showing the willingness to share. **Table 1** shows what a typical shared instrument laboratory for the life sciences looked like in this pre-ABRF era. You can see that cost recovery is a longstanding issue.

The RRF group also distributed an "unknown" for sequencing by the shared instrumentation laboratories.[3] The first set included a peptide designed to determine how these new, fancy, automated, expensive

**TABLE 1**

Typical Core Facility in 1987

| Feature | Number |
|---|---|
| Instruments | 7 |
| Staff | 3 |
| Total operating budget | $158,000 |
| Cost recovery | 43% |

(for that time) instruments performed in the working laboratory, not just in the manufacturer's research and development laboratory. Instrument performance in working laboratories with diverse sample types experienced difficulties matching performance levels touted by instrument marketing groups. The mismatch was approached by demonstrating what could reasonably be accomplished by users with the new instruments. Standards and controls are usually not available in early days of implementation of a new technological capability. Although needed standards usually come later,[4] these researchers recognized their value early on to establish realistic expectations among peers.

These results, based on sequencing the "unknown," provided all users of the then-current instrumentation a view of how the instruments performed. It was data from real-life protein sequencing; concrete data on the performance capability published for others to see and compare to their own data. Briefly, the average for the first 24 residues of the 40-residue peptide were determined with 85% accuracy. Interestingly, 2 respondents (4%) reported instrument failures, but that was also important information about the performance of the protein sequencing instruments.[3] Our current 15 research groups have expanded on these prototypes of assessing capabilities of core facilities and providing data about performance in core facilities. With each new generation of instruments, we continue to see the Research Groups evaluating them by testing capabilities and "kicking the tires."

We now come to 1989 and leave the name RRF behind. ABRF was organized in 1988 to continue the work already started and was incorporated in the state of Delaware in 1989.

Three decades later, core facilities are ubiquitous. I see several hundred of you here proving that. Research groups are now firmly established as a preeminent activity for members, ABRF, and the greater scientific community. Remember, this is a society of volunteers; it is you who are responsible for achieving all of these successes!

Beginning in 1990, the association's first publication, ABRFNews,[5] disseminated information about ABRF such as subcommittee reports (now called Research Group reports), editorials, meeting information, ideas and news forum, employment opportunities, and other items of interest to ABRF members. Over the years and through several iterations, this has become the *Journal of Biomolecular Technologies* (JBT). 1990 was another notable year in a different way: ABRF established annual dues for both voting laboratory directors and nonvoting associates.[6]

In 1991, ABRF had grown to 200 laboratory directors and 148 staff.[7] ABRF studies had already yielded 12 publications that included the unknowns and other studies.[8] ABRF received a National Science Foundation grant for research group studies.[9]

In 1994, the first ABRF Award for Outstanding Contributions to Biomolecular Technologies was bestowed upon Dr. Frederick Sanger, recognizing his development of sequencing technologies for both proteins and nucleic acids.[10] Also, an unedited, free e-mail–based bulletin board called ABRFList was started and is still going as the ABRF Discussion Forum.

In 1995, ABRF had 525 laboratory directors and associates.[11] The Department of Energy awarded ABRF a 3-yr research grant for continued operation.[12] More than 650 representatives from core facilities attended the 10th meeting of ABRF.[13]

The first of the series of independent annual meetings started in 1996[14] and continues: You are here demonstrating the series continues.

The *Journal of Biomolecular Techniques: The Official Methods Journal of the Association of Biomolecular Resource Facilities* was announced in 1997,[15] and it has evolved into our current JBT. ABRF joined The Federation of American Societies for Experimental Biology in 1997.[16] More than 200 of the laboratories voted to dilute their voting power and change the unit of ABRF membership universally to the individual.[17] The current ABRF logo was selected.[18]

Only a very small fraction of the activities over these 30 yr could be described here; more information is available in past issues of ABRFNews on the web site.

What has been accomplished has been by all of us, past and present, the hard-working volunteers who see the value in working together to learn from each other and to address common challenges. You all are to be congratulated! This is our 30th anniversary. I would like to see ABRF have a 50th anniversary. I suspect that ABRF people will make it happen.

Now for the fine print and references:

Thanks to all the people who made ABRF possible and who continue to keep it thriving. Much of the early work on organizing ABRF was supported by the University of Wisconsin Biotechnology Center (Richard Burgess, director). It is hard to imagine how many hours we spent on phone calls and at conferences to get ABRF off the ground. The University of Wisconsin Biotechnology Center is acknowledged here for promoting the vision that became us: the ABRF.

We have quickly journeyed to today, now, living the core facility vision, so let's hear Christopher Mason tell us something about the future. Thanks for listening; I will be at the reception for questions and comments. And I will be a little more relaxed.

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